Teacher Research Projects in Computing

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ABSTRACT

The introduction of computer science (CS) to the National Curriculum for schools in England has led to a situation where teachers must develop both subject knowledge and pedagogical expertise in parallel, which presents a significant challenge. Professional development to address this may be most effective when situated in the teachers' own working practices. This paper describes a project to support CS teachers in developing pedagogical skills by planning, designing and implementing their own classroom-based research, supported by university colleagues.

CCS Concepts

•Social and professional topics → Computing education; K-12 education;

Keywords

action research, computer science education, computing teachers, professional development

1. INTRODUCTION

The inclusion of computer science (CS) within England's school curriculum has foregrounded issues of subject professional development (PD) for many teachers. Menekse's recent systematic literature review of CS PD programmes analyses a parallel development in the USA [11]. The 21 studies examined describe mainly workshops or short courses focusing on subject knowledge. Less than half had more than 50 hours of PD. The predominant focus on workshops for teacher PD in CS suggests an emphasis on a deficit model [8]. Other approaches enabling teacher collaboration via activities that take place within a community of practice have met with notable success [5, 13, 12]. These examples reflect a more sociocultural view of teacher learning; learning which is distributed across people and tools [14].

Drawing upon the work of Jean Lave and Etienne Wenger on situated learning [9] it is apparent that teacher expertise is closely linked to the circumstances to which it pertains: not to precise situations, but to the particular working practices and the associated ways of thinking which define their professional circumstances. Teacher PD in CS is no exception and it may therefore be beneficial to situate PD within a teacher's own practice. Moving from legitimate peripheral (novice) [9] to full (expert) participation in the community of practice is part of the learning process and facilitates formation of CS teacher identity [6].

We designed a project to support CS teachers in implementing their own classroom research as a means of PD. The project was driven by a desire to engage teachers fully in their own PD at a time when many report low confidence in teaching CS.

2. CLASSROOM-BASED RESEARCH

Action research in education involves teachers working with their students and reflecting on their own work [7]. It can be defined as "the study of a social situation with a view to improving the quality of action within it." [4, p.69], although Cohen and Manion prefer to define it as a "small-scale intervention of the functions of the real world and a close examination of the effects of such an intervention" [2, p.186]. Classroom-based research is a process in which educators study problems scientifically so that they can evaluate and steer decision-making and practice [3], cited in [2], and enables us to understand how one can effect social change [10].

Action research thus empowers teachers to investigate changes in their own practice and to measure the impact on their learners. This contrasts with the often didactic objectives of formal PD sessions and "recognizes teachers' central roles in decision making, based upon the needs of their students and schools" [p.501][1].

3. THE TICE PROJECT

The Teaching Inquiry in Computing Education (TICE) project ran from July 2015 to June 2016. Its intention was to give CS teachers an opportunity to develop their understanding of CS pedagogy by supporting them in the im-

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plementation of a classroom-based research project. A distributed community of inquiry developed, with teachers not normally co-located collaborating to build pedagogy knowledge.

3.1 Structure and participation

Participants (N=22) were recruited from the Computing At School (CAS) community and selected by application form. Selection criteria were that they were currently teaching CS at primary or secondary level, and were not in their pre-service training year.Teachers were encouraged to reflect on their interests when completing the application form and before the first meeting to establish a research question that interested them.

The project was structured around two face-to-face training days, the first to explain research methods and to formulate a research question (22 attendees) and the second to guide data analysis and reporting (15 attendees). Six university lecturers in CS education provided support throughout the process. Funding received for the project was used to support teachers to attend the two training days. The first meeting was held in October and the second in March, and in between the two days teachers worked on their research intervention with the support of the academic team and an online group area which had been designed for collaborative work.

3.2 Data collection

To investigate the effectiveness of the project, we planned data collection activities relating to teachers' progress using a combination of questionnaires, video recordings, contributions to the online community, and the resultant project work produced by teachers. Teachers completed questionnaires following each meeting and at the end of the project. Teachers were videoed describing their potential project to the whole group in the first meeting and most were videoed privately during the second meeting to record their perceptions of the programme. Ethics procedures were strictly adhered to: all teachers were given full information about the research and gave informed consent before joining the project.

3.3 Output from the project

At the second meeting, teachers discussed their results with each other and further analysed their findings. They then prepared infographics summarising their work using a common template provided for this purpose. A booklet was developed to showcase their work and this was sent to teachers' schools, distributed at events, and made available online. 12 of the teachers presented their results at a CAS teachers' conference, which also provided them with feedback on their research findings from their peers.

Video data from the project gives a rich insight into the teachers' thinking about their teaching and how classroom research can help them develop their CS pedagogy. Initial analysis of this data suggests that the engagement in the project has developed teachers' confidence in Computing pedagogy.

4. CONCLUSION

There is clear evidence in the literature that classroom-based action research is effective in enabling teachers to make changes to their teaching, instigate change in school and gain ownership of their PD. We have described a project to support teachers' professional development in the teaching of CS by engaging them in classroom research. Data collected through the project demonstrated that participant Computing teachers were enabled to reflect on their own teaching, helping them to better understand their own subject, and improve students' learning. This work is part of a broader move to support Computing teachers interested in research.

5. ACKNOWLEDGMENTS

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